What is claimed is:

1. A group III-nitride semiconductor substrate comprising:

a ZrB_2 single crystal base having a defect density of 10^7 cm^{-2} or less;

a low-temperature buffer layer consisting of a $B_xAl_yGa_zIn_{1-x-y-z}N$ ($0 \leq x \leq 1$, $0 \leq y \leq 1$, $0 \leq z \leq 1$, $0 \leq 1-x-y-z \leq 1$) single crystal which is grown or deposited on said ZrB_2 single crystal base substantially without creation of any Zr – B – N amorphous nitrided layer caused by the reaction between a nitrogen atom and said ZrB_2 single crystal base; and

a semiconductor layer consisting of a $B_aAl_bGa_cIn_{1-a-b-c}N$ ($0 \leq a \leq 1$, $0 \leq b \leq 1$, $0 \leq c \leq 1$, $0 \leq 1-a-b-c \leq 1$) single crystal grown on said low-temperature buffer layer, said semiconductor layer having an element-forming surface with a dislocation density of 10^7 cm^{-2} or less in its entirely.

2. A semiconductor optical element formed on the semiconductor substrate as defined in claim 1.

3. The semiconductor optical element as defined in claim 2, which includes an electrode formed on the side of said base.

4. A method of producing a group III-nitride semiconductor substrate, essentially consisting of:

a first step of forming a low-temperature buffer layer consisting of $B_xAl_yGa_zIn_{1-x-y-z}N$ ($0 \leq x \leq 1$, $0 \leq y \leq 1$, $0 \leq z \leq 1$, $0 \leq 1-x-y-z \leq 1$), on a ZrB_2 single crystal base having a defect density of 10^7 cm^{-2} or less, at a base temperature allowing said

low-temperature buffer layer to be grown or deposited on said ZrB_2 single crystal base substantially without creation of any Zr – B – N amorphous nitrided layer; and

a second step of successively to said first step, growing a single crystal film consisting of $B_aAl_bGa_cIn_{1-a-b-c}N$ ($0 \leq a \leq 1$, $0 \leq b \leq 1$, $0 \leq c \leq 1$, $0 \leq 1-a-b-c \leq 1$), directly on said low-temperature buffer layer, to form a semiconductor layer consisting of $Al_aGa_{1-a-b}In_bN$ ($0 \leq a \leq 1$, $0 \leq b \leq 1$, $0 \leq 1-a-b \leq 1$) which has an element-forming surface with a dislocation density of 10^7 cm^{-2} or less in its entirely.

5. The method as defined in claim 4, wherein said low-temperature buffer layer is formed as a single crystal at the time said first step is completed.

6. The method as defined in claim 4, wherein said low-temperature buffer layer is polycrystalline or amorphous at the time said first step is completed, and formed as a single-crystal at the time said second step is completed.

7. The method as defined in either one of claims 4 to 6, wherein said low-temperature buffer layer has a thickness in the range of 10 nm to 1 μm.